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Preliminary Feasibility Study of Resource Recovery for Volusia County, Florida

CSI Resource Systems, Inc.
Boston, MA

Prepared for

Environmental Protection Agency
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Solid Waste

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A TECHNICAL ASSISTANCE PROGRAM REPORT

PRELIMINARY FEASIBILITY STUDY OF RESOURCE RECOVERY FOR VOLUSIA COUNTY, FLORIDA

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RESOURCE RECOVERY AND CONSERVATION PANELS

SEC. 2003. The Administrator shall provide teams of personnel, including Federal, State, and local employees or contractors (hereinafter referred to as "Resource Conservation and Recovery Panels") to provide States and local governments upon request with technical assistance on solid waste management, resource recovery, and resource conservation. Such teams shall include technical, marketing, financial, and institutional specialists, and the services of such teams shall be provided without charge to States or local governments.

This report has been reviewed by the Project Officer, EPA, and approved for publication. Approval does not signify that the contents necessarily reflect the views and policies of the Environmental Protection Agency, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

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This report presents the results of a preliminary determination of the feasibility of resource recovery in Volusia County, Florida. This study contains specific information on first order estimates of waste quantity, an evaluation of the market potential, development and assessments of solid waste management options and an examination of legal and institutional aspects of resource recovery. Assistance rendered by this study led to the City of Daytona Beach being selected as an URBAN POLICY GRANTEE in February 1979 which affords Daytona Beach special financial help in its Phase I planning stage for resource recovery implementation.

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PRELIMINARY FEASIBILITY STUDY OF RESOURCE RECOVERY FOR VOLUSIA COUNTY, FLORIDA

PREPARED FOR

OFFICE OF SOLID WASTE MANAGEMENT
U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION IV, ATLANTA, GEORGIA

BY

CSI RESOURCE SYSTEMS, INC.
BOSTON, MASSACHUSETTS

JUNE 1979

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PREFACE

The report was prepared for the County of Volusia, Florida under the U. S. Environmental Protection Agency's Technical Assistance Program to state and local governments interested in implementing resource recovery. The report was prepared as a result of a request to the U. S. EPA Region IV from the County Manager. The request also was supported by the Florida Department of Environmental Regulation. This report contains the results of several site visits to Volusia County by CSI Resource Systems, Inc., as well as interviews with the Florida Department of Corrections, City of Daytona Beach; contacts with Florida Power Corporation, Florida Power & Light, and the Florida Public Service Commission; and a review of all available solid waste management and related studies. Resource Systems is a technical assistance contractor to the Office of Solid and Hazardous Waste, U. S. EPA Region IV. Under the terms of the Technical Assistance Programs, the entire cost of Resource Systems' technical assistance activities on behalf of Volusia County was paid for by the U. S. EPA.

The report presents the results of a preliminary determination of the feasibility of energy recovery. Such determination involved development of first-order estimates of waste quantity generated within Volusia County; evaluation of the market potential for energy recovery; development and assessment of alternative solid waste management options; and examination of some of the legal and institutional aspects of resource recovery implementation.

Several months subsequent to the initiation of technical assistance work by Resource Systems, the City of Daytona Beach submitted a preapplication to the U. S. EPA for implementation planning funds under the President's Urban Policy Program for a codisposal, electricity generation facility to service both the City's wastewater treatment plant and water works. This was one of the options under investigation by Resource Systems. In late February 1979 the City of Daytona Beach was notified that it had been selected to negotiate a cooperative agreement with U. S. EPA Region IV under this new program. It is believed that the results of the technical assistance activity should enable the City to identify critical tasks to be accomplished as part of its Phase I activities under an Urban Policy grant.

This report could not have been prepared without the generous cooperation of a number of persons and organizations. Resource Systems wishes to thank especially the following individuals for their support:

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CHAPTER I

SUMMARY OF FINDINGS AND CONCLUSIONS

Study Objectives

The purpose of this investigation was to determine on a preliminary basis the economic and technical feasibility of resource recovery in Volusia County, Florida. Preliminary determination of the feasibility of resource recovery is intended to assist the County in partially fulfilling the requirements of Chapter 403.7 of the Florida Statutes which requires the County to adopt a resource recovery and management program.

Because the County's economic base is to a large extent dominated by tourist and agricultural activities, it appears that the most viable form of resource recovery would be the production of electricity for use by public entities, or the production of electricity for sale to one of the three utilities which operate in Volusia County--Florida Power and Light, New Smyrna Beach Utilities or Clay Electric. Three public users of electricity were identified: the County, the City of Daytona Beach, and the State of Florida, Department of Corrections. The production and sale of electricity from a publicly (County or City) sponsored recovery facility and its sale or use by a publicly owned facility will probably require approval by the Florida Public Service Commission.

Four systems/electricity buyer configurations were analyzed and their economics compared to the cost of continuing to dispose of solid waste at the two County-owned and -operated landfills. The four configurations investigated were:

1) The production of electricity for sale to the Florida Power and Light Company, New Smyrna Beach Utilities, or Clay Electric.

2) The cogeneration of steam and electricity for sale to the County and State Correctional Facilities Complex.

3) The production of electricity for various County facilities with wheeling service provided by Florida Power and Light Company.

4) The production of electricity for sale to the City of Daytona Beach's Regional Wastewater and Water Treatment Plants. This option included systems with and without codisposal capability.

For each of the above configurations, four waste flow assumptions were considered:

1) All of the processible solid waste currently delivered to the County-operated disposal facilities could be obtained.

2) The processible solid waste from the eastern portion of the County currently disposed of at the Tomoka Farms landfill, including that from Daytona Beach, could be obtained.

3) All of the processible solid waste currently disposed of at Tomoka Farms and Plymouth Avenue sites, with the exception of Daytona Beach, could be obtained.

4) Only the City of Daytona Beach's solid waste would be available.

Findings

- Tonnage of waste generated within Volusia County and disposed of at the two County-owned and -operated landfills is unknown. While cubic yards (or volumes) disposed at the two County landfills are recorded, it is not known how accurate the volume data are, since experience elsewhere indicates that packer trucks frequently do not carry full loads.

- In 1978 the cost of disposal at the two County-operated landfills was $630,000.

- Current disposal cost at the County-operated Tomoka Farms facility is estimated at $3.00 per ton, based upon a bulk density assumption of 600 pounds per cubic yard. Irrespective of the bulk density assumption employed, it is clear that the County has extremely favorable landfill disposal costs per ton compared to those which exist in a number of other Florida Counties.

- Current disposal cost at the Plymouth Avenue landfill is estimated at $5.00 per ton.

- The cost of disposal for Daytona Beach exclusive of collection and transportation presently ranges from $4.00 to $5.33 per ton, depending upon whether a 600- or 450-pound per cubic yard density factor is utilized.

Conclusions

- Estimates of the bulk density of solid waste from various Florida communities range from a low of 346 to a high of 600 pounds per cubic yard. This significant variance in density factors and the lack of waste compositional data for Volusia County solid waste make it essential that a weighing and compositional analysis program be implemented to determine accurately both the quantity of waste generated within the County and the quantity of processible waste available for resource recovery.

- The estimate of processible solid waste currently available throughout Volusia County (including waste delivered to non-County-operated disposal sites) ranges from 400 to 550 tons per day. However, it is unlikely that this quantity of waste would be delivered to a resource recovery facility unless disposal costs, including fees and transportation expenses, were competitive with alternative disposal options.

- A technically innovative and, to date, unproven 330 TPD (250 TPD nominal) codisposal modular combustion system producing electricity from solid waste and sludge for sale to the Daytona Beach Water Treatment and Waste Water Plants appears do-able, and with benefit of Federal 201 grant, appears economically viable.

- Because of its modest steam and electricity requirements, the combined County and State Correctional Complex should not be considered as a primary customer for energy produced by a resource recovery system. However, the Correctional Complex could be a secondary customer, purchasing a portion of the steam or electricity produced by a resource recovery system in excess of the requirements of its primary customer.

- Currently there are no markets with sufficient demand for process steam located within Volusia County to justify a resource recovery system producing steam as its primary energy product.

- Revenues from the sale of electricity at wholesale to Florida Power and Light, or at an equivalent cost basis to to New Smyrna Beach Utilities or Clay Electric, appear insufficient to provide a viable economic basis for considering this resource recovery option.

- The decentralized locations and moderate electricity requirements of the major County departments preclude the production of electricity for these various facilities.

- There appear to be no economies of scale in the range of systems appropriate for Volusia County. Thus, systems with capacity in excess of a 250-ton-per-day range would be no more cost-effective, even if sufficient waste supplies could be assured.

Recommendations

- Daytona Beach should pursue the in-depth technical feasibility investigation of the innovative 330 TPD_7 (250 TPD_7 nominal) codisposal modular combustion resource recovery system. While this system projects 1983 per-ton disposal costs of approximately $11.00 compared to costs ranging from $5.24 to $6.99 per ton (exclusive of the impact of RCRA) for the continued landfilling disposal alternative, significant additional benefits accrue to the City. It is envisioned that the City will enjoy exceptionally favorable sludge disposal costs as a result of this codisposal system, and as well effect refuse vehicle operational and maintenance savings.

- Volusia County should endorse the concept of a modular codisposal resource recovery system and support the City of Daytona Beach in this undertaking, because such a facility will greatly extend the projected life of the County-operated Tomoka Farms site. As well, this system will provide sludge disposal services on a regional basis, allowing the County to concentrate its resources and personnel on solid waste and residuals management.

TABLE 1

COMPARISON OF 1983 PROJECTED LANDFILL
DISPOSAL COSTS WITH RESOURCE RECOVERY OPTIONS

	Tomoka Farms Landfill	250 TPD_7 Modular [1] Combustion System with Electricity Production	250 TPD_7 Modular [2] Combustion Codisposal System with Electricity Production	400 TPD_7 Mass Burn [3] Codisposal Incinerator with Electric-Production
Waste Processed (TPY)	222,824	91,250	102,100 [4]	156,950 [5]
Capital Costs		$12,235,000	$11,638,000 [6]	$48,642,000 [7]
Total Annual Costs	$876,000	$ 1,970,000	$ 2,177,000 [8]	$ 7,065,000 [9]
Less Revenues	0	$<1,124,000>	$<1,034,000>	$<3,218,000>
Net Disposal Cost	$876,000	$ 846,000	$ 1,143,000 [8]	$ 3,847,000 [9]
New Disposal Cost/Ton	$4.00*	$9.00	$11.00 [8]	$24.00 [9]

[1] Without Federal Grant.

[2,3] With partial Federal Grant.

[4,5] Includes 10,950 TPY sludge at 30% solids.

[6,7] Full codisposal capital costs less Federal Grant of $5,682,600.

[8,9] Costs for both MSW and sludge.

* 1983 projected landfill disposal cost is exclusive of impact of future RCRA mandated capital improvements and changes in operational procedures. The City of Daytona Beach, however, is estimated to pay $7.00 per ton based upon escalation of its 1979 disposal fee of $1.20 per cubic yard, or $5.33 per ton based upon a bulk density of 450 pounds per cubic yard.

CHAPTER II

INTRODUCTION

Background

Volusia County is located on the east coast of Florida, approximately 250 miles north of Miami, 90 miles south of Jacksonville, and 30 miles northeast of Orlando. University of Florida population estimates indicated a 1977 County Population of 219,175.

Population is concentrated in the easternmost portion of the County in the principal cities of Daytona Beach (51,129), Ormond Beach (18,411), New Smyrna Beach (15,582), Port Orange (10,137), South Daytona (9,315) and Holly Hill (8,743). These six cities alone constitute over 50 percent of the County's population.

Deland (14,496), the County seat, is located in the western portion of the County. The remaining population inhabits seven smaller communities, ranging in size from less than 700 to 4,500, five unincorporated areas, and the undeveloped rural areas of the western part of the County.

Volusia County Planning Department population estimates project a 1990 population approximating 313,000, indicating an annual growth rate of 2.78 percent. In absolute terms, the eastern portion of the County will achieve most of this growth. For a breakdown of this growth, refer to Table 2.

A 1974 study, entitled Population and Economic Analysis of Volusia County, Florida, by Gould Associates, described the Volusia County economy as tourist-oriented with significant service and retail activities. Other employment sections included government, light manufacturing and agriculture.

The Gould Associates study projects that future growth in economic activity would be largely restricted to the commercial development and service industries. Tourism would continue to play an important role in the County's economy.

Solid Waste Practices

The County operates two landfills--the Tomoka Farms Disposal Facility in the eastern section of the County and the Plymouth Avenue Facility in the western part of the County. These two facilities receive a substantial portion of the residential waste generated within the County. However, there are other disposal facilities which also accept waste from various communities and, in a real sense, are in competition with the respective County-operated facilities.

The other facilities include a privately owned and operated landfill near Lake Marie; the Ormond Beach landfill, which is operated by the City of Ormond Beach, accepting waste from Ormond Beach and Holly Hill; the Port Orange incinerator, accepting waste from Port Orange and Daytona Beach Shores; the Lake Helen City Landfill, operated by Lake Helen for disposal of its own solid waste; and a small landfill operated by Oak Hill. County personnel anticipate that in the next few years some of these communities will resort to disposal at Tomoka Farms, especially as their facilities reach capacity.

For a summary of these facilities, the communities they serve with estimates of annual solid waste tonnages delivered and projections of remaining useful life, refer to Table 3.

The waste received at the two County-owned facilities, mainly residential in nature, reflects the modest amount of industrial activity in the County. An estimated 631,924 cubic yards of solid waste was delivered to the Tomoka Farms landfill in the period October 1977 through September 1978. This represents 189,553 tons per year and a daily tonnage of approximately 519 tons (365-day basis) when utilizing a bulk density conversion factor of 600 pounds per cubic yard corresponding to the County's bulk density estimate. (See Table 4.)

The County uses a bulk density factor of 600 pounds per cubic yard, as suggested by the Florida Department of Environmental Regulation, to derive its solid waste tonnage and disposal costs. However, this density assumption differs from the 450-pound-per-cubic-yard estimate employed by the City of Daytona Beach. Studies of bulk density sponsored by the Florida Resource Recovery Council on various Florida communities showed wide ranges in density

(346 to 500 pounds per cubic yard) indicating the need for a weighing program to accurately determine the quantity of solid waste generated within Volusia County.

The County-operated Plymouth Avenue disposal facility located in the western portion of the County received approximately 117,000 cubic yards of solid waste in the same October 1977 to September 1978 period. Utilizing a bulk density conversion factor of 350 pounds per cubic yard indicates annual and daily tonnage of 20,480 TPY and 56 TPD, respectively. A lower bulk density factor for the Plymouth Avenue site was used to reflect the fact that a greater percentage of the solid waste delivered to this facility is in non-compacted form than that delivered to the Tomoka Farms site. A 1976 report by Greenleaf and Telesca entitled, Comprehensive Solid Waste Study, Volusia County, Florida, indicated a 1975 bulk density factor of 300 pounds per cubic yard at Plymouth Avenue facility. (See Table 5.)

Daytona Beach is the major generator of solid waste in the County, currently producing an estimated 200 tons per day. This quantity of solid waste represents nearly 40 percent of the waste delivered to the Tomoka Farms landfill.

The City currently pays the County a disposal fee for waste delivered to Tomoka Farms at the rate of $1.20 per compacted cubic yard. Uncompacted solid waste is charged $.60 per cubic yard. On a per ton basis the cost of disposal for Daytona Beach, exclusive of collection and transportation presently ranges from $4.00 to $5.33 depending upon whether a 600 or 450 pound per cubic yard density factor is utilized.

Of the waste received at the various facilities, a substantial portion would not be acceptable at an energy recovery facility. Based on the experience of other communities, it has been assumed that 20 percent of the waste received at the various facilities would be unprocessible for resource recovery. Nonprocessible waste would include items such as construction debris, tree stumps, brush and oversized bulky waste. As a result, the waste available for resource recovery would be reduced to approximately 415 tons per day at the Tomoka Farms landfill and to 45 tons per day at the Plymouth Avenue facility.

Because of the significant impact of tourism on the waste generation within Volusia County and the typically higher portion of combustibles attendant with tourist related waste, this 20 percent unprocessible assumption could prove conservative. This uncertainty coupled with the lack of definitive bulk density data further argues for the implementation of a county weighing and compositional analysis program.

For the sake of analysis, a 3 percent annual growth factor in solid waste generation has been employed. This rate assumes that there will be no per capita increase in solid waste generated. Rather, increases in the annual quantity of solid waste will be a function of population in growth projected at approximately 3 percent for the entire County over the period 1979 to 1990. (See Table 6.)

It is apparent that Volusia County's considerable tourist related activity will continue to contribute significantly to the quantity of solid waste generated within the County. However, it is believed that the inevitability of Federal beverage container legislation; a reduction in redundant and energy intensive industry packaging practices; and increased in-house recycling efforts by the industrial and commercial sectors will tend to stabilize per-capita waste generation rates.

The County maintains comprehensive records of disposal costs at Tomoka Farms and Plymouth Avenue landfill sites. Current costs are estimated at $3.00 and $5.00 per ton. Recently implemented HiRise disposal techniques at Tomoka Farms are expected to result in more efficient operations at this site. As a consequence, the impact of inflation upon operational costs at Tomoka Farms will be mitigated. A modest 7-percent annual escalation factor has been assumed and is reflective of the inflationary impact upon fuel, labor and equipment.

It should be pointed out, however, that this projected escalation factor is exclusive of the cost impact of the recently proposed amendments to the Resource Conservation and Recovery Act (RCRA) which may mandate extensive modifications to existing landfills including gas migration control and monitoring, leachate control and monitoring, surface runoff control systems, as well as increased daily and final

coverage factors. According to the Draft Environmental Impact Statement on the Proposed Guidelines for the Landfill Disposal of Solid Waste, the immediate impact of these changes will be to increase the per ton cost of disposal of a typical 300 ton per day model landfill by approximately $2.00, nearly 50 percent above current estimated disposal cost of $4.00 per ton for a facility of this size.

TABLE 2

POPULATION ESTIMATES

	1977[1]	1980[2]	1990[2]	Growth Factor
Daytona Beach	51,129	57,723	70,000	2.45%
Ormond Beach	18,411	19,370	31,000	4.09%
Deland	14,496	15,712	21,120	2.94%
New Smyrna Beach	15,682	16,476	22,062	2.66%
Port Orange	10,147	13,496	18,088	4.55%
South Daytona	9,315	10,043	13,449	2.87%
Holly Hill	8,743	9,451	12,656	2.89%
Edgewater	4,567	4,799	6,426	2.66%
Orange City	2,286	2,459	3,295	2.85%
Lake Helen	1,675	1,795	1,914	1.03%
Daytona Beach Shores[3]	1,311	1,402	1,823	2.57%
Ponce Inlet	1,133	1,125	1,507	2.28%
Oak Hill	820	901	1,206	3.01%
Pierson	701	788	1,056	3.20%
POPULATION OF INCORPORATED MUNICIPALITIES	140,416	155,540	205,602	2.98%
POPULATION OF UNINCORPORATED AREAS	78,759	86,000	107,398	2.41%
VOLUSIA COUNTY: TOTAL POPULATION	219,175	241,000	313,000	2.78%

[1]University of Florida Population Estimates.

[2]Volusia County Planning Department Estimates.

[3]Large seasonal population (10,000+).

TABLE 3

NON-COUNTY-OPERATED DISPOSAL FACILITIES

IN VOLUSIA COUNTY

Facility	Communities Delivering Waste	Population Served	Estimated Annual Tonnage	Estimated Years of Remaining Life
Ormand Beach Landfill	Ormond Beach	18,411	22,000	5
	Holly Hill	8,743	unknown	
Lake Marie Landfill (private)	Deland	14,496	unknown	1-2
	Orange City	2,286	"	
	Other Incorporated Areas: (Debary, Deltona, Enterprise and Osteen)	Unknown	"	
Port Orange Incinerator	Port Orange	10,147	7,500	10
	Daytona Beach Shores*	1,311		
Lake Helen City Landfill	Lake Helen	1,675	350	5
Oak Hill City Landfill	Oak Hill	820	550	8

Source: Volusia County, Sanitation Department.

*This community has a seasonal influx of tourists, which must be considered when projecting figures.

TABLE 4

ESTIMATES OF SOLID WASTE DELIVERED TO TOMOKA FARMS DISPOSAL SITE

October 1977 - September 1978

Month	Recorded Monthly Volume	Estimated* Monthly Tonnage	Average Daily Tonnage
October '77	49,896	14,969	483
November '77	45,746	13,724	457
December '77	46,136	13,841	446
January '78	48,441	14,532	469
February '78	43,354	13,006	465
March '78	59,376	17,813	575
April '78	57,991	17,397	580
May '78	57,180	17,154	553
June '78	56,775	17,003	568
July '78	55,365	16,610	536
August '78	59,228	17,768	573
September '78	52,356	15,707	524
TOTAL	631,844	189,553	519
LESS: UNPROCESSIBLES AT 20%			< 104 >
TOTAL DAILY WASTE AVAILABLE FOR RESOURCE RECOVERY			415

Source: Monthly volume data (cubic yards) are from Volusia County, Sanitation Division records.

*Assumes density of 600 lbs. per cubic yard.

TABLE 5

ESTIMATES OF SOLID WASTE DELIVERED TO PLYMOUTH AVE. DISPOSAL SITE

October 1977 - September 1978

Month	Recorded Monthly Volume	Estimated* Monthly Tonnage	Average Daily, 7 Tonnage
October '77	9,728	1,703	55
November '77	8,227	1,440	48
December '77	8,610	1,507	48
January '78	8,101	1,418	46
February '78	7,905	1,384	50
March '78	10,826	1,895	61
April '78	10,982	1,922	64
May '78	10,958	1,918	62
June '78	9,724	1,703	55
July '78	10,012	1,752	57
August '78	11,420	2,000	65
September '78	10,536	1,844	61
TOTAL	117,029	20,480	56
LESS UNPROCESSIBLES AT 20%			< 11 >
TOTAL DAILY WASTE AVAILABLE FOR RESOURCE RECOVERY			45

Source: Monthly volume data (cubic yards) are from Volusia County, Sanitation Division records.

*Assumes density of 350 lbs. per cubic yard.

TABLE 6

SOLID WASTE PROJECTIONS AT 3 PERCENT GROWTH RATE
FOR COUNTY-OPERATED LANDFILLS

Year	Solid Waste		Processible Waste*	
	TPD$_7$	TPY	TPD$_7$	TPY
1978 (0)	658	240,000	526	192,000
1979 (1)	678	244,500	542	198,000
1980 (1)	698	255,000	558	209,000
1981 (3)	714	262,000	575	210,000
1982 (4)	741	270,000	593	216,000
1983 (5)	763	278,000	610	223,000
1984 (6)	786	287,000	629	230,000
1985 (7)	809	295,000	647	236,000
1986 (8)	834	304,000	667	244,000
1987 (9)	859	314,000	687	251,000
1988 (10)	884	323,000	707	258,000
1990 (11)	911	333,000	729	266,000
1991 (12)	938	342,000	750	274,000
1992 (13)	966	353,000	773	282,000
1993 (14)	996	364,000	797	291,000
1994 (15)	1,025	374,000	820	299,000

*Assumes unprocessible component at 20%

CHAPTER III

POTENTIAL ENERGY MARKETS

A market survey was undertaken to determine if there were potential buyers for various forms of recovered energy which could be provided by a resource recovery system. Markets were considered for steam, steam/electricity (cogeneration), refuse-derived fuel, and electricity. The market survey indicated that the demand for steam was insufficient to justify a steam generation system. This is reflective of the industrial profile of Volusia County, where little energy-intensive manufacturing activity is present.

A resource recovery system which would produce a refuse-derived fuel for sale to either Florida Power Corporation or Florida Power and Light Company was also considered. However, the nearest Florida Power Corporation facility which could utilize an RDF fuel is a coal-fired unit some 160 miles away in Crystal River, and the closest Florida Power and Light coal-fired facility is approximately 200 miles away.

Less than 70 percent of the solid waste supply can typically be converted into RDF; the remainder is either noncombustible or too difficult to process. The result is significantly reduced tonnages of RDF from available solid waste quantities.

Because of the high costs of transporting RDF over 150 miles and the modest quantities of RDF which could be produced from the available County-controlled waste supply, RDF production options were dismissed from further consideration.

The production of electricity for sale to one of the three utilities operating in Volusia County or the production of steam and electricity to a county- or city-owned facility emerged as the only viable market options remaining. To that end, a number of potential market situations were investigated, including the following:

- Production of electricity for sale to the Regional Waste Water and the Daytona Water Treatment Plants.
- Production of electricity and steam for sale to the combined County and State correctional complex.

- Production of electricity for sale to the various County facilities with wheeling services provided by Florida Power and Light.

- Production of electricity for sale to Florida Power and Light, New Smyrna Beach Utilities, or Clay Electric.

Production of Electricity for Sale to the Regional Waste Water and Daytona Water Treatment Plants

Various sludge disposal options for the City of Daytona Beach and other communities in the eastern portion of Volusia County were evaluated by the engineering firm of Russell and Axon in a recently completed report entitled "Sludge Disposal Alternatives Study, City of Daytona Beach." In this study seven technology options were assessed and a system described as filter-press dewatering and mixed-refuse controlled air incineration with heat recovery for power generation emerged as the most cost-effective sludge disposal alternative. Under this technology, low-pressure steam is produced from the combustion of mixed refuse and dewatered sludge. The low-pressure steam is directed through a turbo generator to produce electricity.

The system as outlined in the Russell and Axon study has a design capacity enabling it to dispose of approximately 300 TPD of solid waste and 50 TPD of sludge at 30 percent solids. The electricity produced would be sold to the regional waste water and water treatment plants to meet the electrical requirements of the respective facilities. This concept of modular codisposal combustion with electricity generation as endorsed by Russell and Axon was further evaluated by Resource Systems to assure technical consistency and economic viability. It appears that modular codisposal to produce low-pressure steam for the generation of electricity is one viable resource recovery option for the City of Daytona Beach. Three factors make this concept worthy of in-depth study:

- The scale of the modular combustion system envisioned to meet the approximate electricity requirements of the waste water and water treatment plants could be supported by a quantity of processible solid waste which could readily be acquired.

- The technology and scale of the appropriate system has some operating history and demonstrated reliability.
- A system to provide electricity to the waste water and water treatment plants could be eligible for Federal grant assistance under PL 92-500, were it to provide sludge disposal capability.

However, several significant institutional and technical issues must be resolved before committing to this resource recovery option. These include:

- Obtaining a Public Service Commission ruling that the resource recovery facility would not be subject to utility rate setting constraints and that the facility would not violate the electrical production and distribution franchise of Florida Power and Light.
- Overcoming the technical uncertainty of coupling steam produced from municipal solid waste with turbo generators. (The operating parameters of low-pressure steam turbine generators has been firmly demonstrated. However, the variability in the quantity of steam produced from a given amount of MSW could present operational difficulties.)
- Determining the electricity requirements of the respective waste water and water treatment plants and matching this demand with the electricity produced from the resource recovery facility.

Production of Electricity and/or Steam for Sale to the Combined County and State Correctional Complex

The State is currently constructing a correctional facility to be located in the eastern portion of Volusia County contiguous to the existing County correctional complex. This facility will have an ultimate inmate population of 624 plus housing to accommodate personnel. It is planned that the complex would purchase electricity from Florida Power for air conditioning, heating, light and other electrical purposes. Air conditioning will be limited to classrooms, infirmary and the administration complex. Steam will be produced by a small package boiler to provide steam and hot water for kitchen and laundry applications.

Electricity consumption is estimated to be in the range of 250 kilowatts per hour, and steam consumption figures are estimated to be in the neighborhood of 3,000-5,000 lbs of steam per hour. These projections are

based upon actual operating parameters of other State correctional facilities of this size and design.

An energy demand of approximately 250 kwh of electricity and 5,000 lbs of steam per hour could be provided by a resource recovery system, but such a low demand is estimated to require only 25 tons per day of solid waste. The combined energy requirements of the County and State Correctional Complex would be approximately double this figure. — 50 TPD

Because of the modest energy demands, it was concluded that the County and State Correctional Complex should not be considered as a prime candidate for an energy resource recovery system. For this reason the County and State Correctional Complex was dismissed from further consideration.

Production of Electricity for Sale to Various County Facilities

The possibility of producing electricity for sale to the numerous County facilities was explored. Under this concept, Florida Power and Light would wheel electricity produced by the resource recovery facility over its transmission lines to the various County facilities. The major County facilities are spread out throughout the County, and as a consequence could not be served directly. The largest of these includes the County Courthouse Annex in Daytona Beach, the City Island Library in Daytona Beach, the Courthouse Annex in New Smyrna, the Vehicle Maintenance Barn in Osteen, the Agricultural Center in Deland, and the County Government Complex in Deland.

Two factors caused this option to be dismissed from further consideration. First, the County would have to get a favorable ruling from the Public Service Commission, enabling it to produce electricity for sale to various retail customers, since Florida Power and Light presently has an exclusive franchise. Second, these various County facilities typically require electricity only 5 to 5-1/2 days per week, 8 to 10 hours per day. Because these County facilities would demand electricity less than one-third of the 168 hours available in a weekly period, revenues from the sale of electricity would be substantially reduced, resulting in unfavorable economics.

Production of Steam or Electricity for Sale to Florida Power and Light Company, New Smyrna Beach Utilities, or Clay Electric Company

Two possible purchase arrangements were initially discussed with Florida Power and Light--Florida Power and Light as a steam purchaser and as an electricity purchaser. Since the closest Florida Power and Light coal-fired facility was 200 miles distant, shipping of RDF was not considered an option. The following reflects Florida Power and Light's corporate policy relative to the purchase of energy and/or electricity from a resource recovery system:

- Florida Power and Light is willing to purchase steam under the arrangements similar to Dade County, where the means of generating electricity are owned by the Company.
- Pricing of fuel purchased from a resource recovery facility would be subject to economic dispatch.
- Sufficient quantities of fuel, steam or electricity must be available to make it worthwhile for the company to purchase same.
- The purchase of electricity would be predicated upon the concept of average fuel cost component.

In Dade County, Florida Power and Light will own the electrical generating portion of the resource recovery system and thus will be able to include this capital investment in its rate base.

Because the ownership of electrical generating equipment is not appropriate under the possible options previously cited, it appears that Florida Power and Light is willing to pay for steam or electricity on a less favorable average system fuel cost basis. Proposed legislation contained in the "Public Utility Regulatory Policies Act of 1978" dictates that the pricing of steam or electricity produced by a resource recovery facility for sale to a public utility be subject to state Public Utility Commission review. In the event that this legislation passes as proposed, sale of electricity or steam to a utility would be predicated upon incremental costs and not the less favorable average fuel costs.

Nonetheless, the current Florida Power and Light position on this subject indicates that significant negotiations would be necessary to

determine the pricing of steam or electricity produced from a Volusia County resource recovery system.

Production of steam was dismissed from consideration for three primary reasons: First, the nearest Florida Power and Light facility is located in Enterprise, the western portion of the County. Transportation of waste to this site would be prohibitively expensive, particularly since the majority of the solid waste generated in the County is in the eastern portion. Second, and more importantly, there are substantial technical impediments to producing steam from municipal solid waste at the high pressure and temperature requirements of Florida Power and Light Company. Third, there are issues of scale. There is some indication that Florida Power and Light would require the minimum steam equivalent of 1,000 tons per day, a figure considerably in excess of both the currently available and future projections of solid waste in Volusia County.

The concept of producing electricity for sale to the Enterprise Plant of Florida Power and Light was also dismissed from further consideration, because the revenues received from the sale of electricity to the utility--even under the more favorable incremental cost pricing basis--would result in a tipping fee considerably in excess of projected landfill disposal costs. As an example, the unsubsidized 250 TPD_7 modular combustion system with electricity generation, selling electricity at retail prices, projects a 1983 net disposal fee of about $9.00 per ton. Revenues realized from the sale of electricity to Florida Power and Light would be at a kwh rate significantly less than retail. Assuming a wholesale price in 1983 of 24.93 mils on the sale of electricity to this utility would result in a net disposal fee of nearly $16.00 per ton.

New Smyrna Beach Utilities and Clay Electric also serve portions of Volusia County and thus were considered as possible customers for electricity produced by a resource recovery system located in the County. New Smyrna Beach Utilities has current capacity of 35 MW and serves approximately 15,000 customers, the majority of which are located in the County. New Smyrna Beach Utilities owns 1/2 of 1 percent of the Crystal River Nuclear Plant, which provides up to 4-1/2 MW, or approximately 13 percent of its base electric requirements. Except for modest peaking capability, New Smyrna Beach generates no electricity. Rather,

it purchases electricity at wholesale from Florida Power and Light and Jacksonville Electric and distributes electricity to its customer.

Clay Electric has a current capacity of 200 MW and distributes electricity to about 60,000 customers, approximately 10 percent of which are in Volusia County. As a member of the Seminole Generation and Transmission Coop, a portion of its requirements are provided by nuclear generated electricity from the Crystal River Nuclear Plant. The remainder is purchased from Florida Power and Light, Florida Power, Jacksonville Electric and the Gainesville Regional Utility Board. Clay Electric does not generate any electricity.

The price of recently purchased non-nuclear-based electricity for these respective utilities has approximated 18 mils (1.8¢/kwh) inclusive of fuel adjustments.

Both utilities have expressed interest in the concept of purchasing electricity from a resource recovery system to replace a portion of their non-nuclear-based electricity requirements. However, the economics of selling electricity to either New Smyrna Beach Utilities or Clay Electric render this concept unfeasible. The most favorable assumption, the sale of electricity at parity on a replacement basis of 18 mils escalated at 15 percent per year, projects a 1983 net disposal cost of $14.00 per ton. This figure is a per-ton increase of $4.00 over the projected 1983 disposal costs of $9.00 resulting from the sale of electricity at retail to the waste water and Daytona Water Treatment Plants.

Because both New Smyrna Beach Utilities and Clay Electric lack generating capability, the concept of producing electricity for sale to either must be dismissed.

CHAPTER IV

ECONOMICS OF SYSTEM OPTIONS

Having identified the Regional Waste Water and the Daytona Water Treatment Plants as the most attractive potential customer for the product of an energy resource recovery system, several economic scenarios were developed which reflect various recovery technologies and system scales. There follows:

- A 250 TPD_7 modular combustion system electricity with electricity generation - 1979 capital and financing costs
- A 250 TPD_7 modular combustion system with electricity generation - 1983 capital and financing costs
- A 250 TPD_7 modular codisposal combustion system with electricity generation - 1983 capital and financing costs and partial Federal grant
- A 400 TPD_7 mass burn codisposal system with electricity generation - 1983 capital and financing costs and partial Federal grant.

The economics of each system were predicated upon the production of electricity for sale to the City of Daytona Beach for use in its waste water and treatment facilities. Although it is unlikely that the proposed Advanced Water Treatment Plant will be operational before 1983, economics were developed for a resource recovery facility operational in 1979 to demonstrate the impact of inflation upon capital and financing costs, electricity revenues and net solid waste disposal fees.

The economics of the various systems operational in 1983, were developed using the following assumptions:

- Capital costs escalate at 10 percent per year
- Bond interest rates increase to 6.75 percent from 6 percent
- Electricity revenues escalate at 15 percent per year
- Operations, maintenance and repair elements escalate at 7 percent per year

Because of the uncertainties attendant with the above assumptions and the limitations of factored capital and O&M costs developed from engineering flow charts (first-order economics), the resultant net disposal fee projections have order-of-magnitude precision. Consequently, aggregate cost components are rounded to the nearest thousand dollars, and per-ton cost components are rounded to the nearest full dollar.

The electricity demand of the combined waste water and treatment plants has been estimated to range from 2500 to 4000 kwh. However, until the ATWP has an operational history, actual electricity requirements will be uncertain. A 250 TPD_7 modular combustion system (with or without codisposal capability) has a projected net electrical production of approximately 2700 kwh and thus can meet from 65 to 100 percent of the demand of the AWTP, depending upon actual electricity requirements.

The 400 TPD_7 mass burn codisposal system has a net projected electrical output of approximately 7700 kwh, easily meeting the estimated electrical requirements for the AWTP.

A 250 TPD_7 Modular Combustion System with Electricity Generation - 1979 Capital and Financing Costs

A 250 TPD_7 modular combustion system with electricity generation - 1979 capital and financing costs was evaluated as previously indicated, to demonstrate the impact of inflation upon capital, financing and operational costs; electricity revenues; and disposal fees. This system is exactly the same as the 1983 modular combustion system with electricity generation.

Six 55 TPD "controlled air incinerator" modules comprise the system. Five of these modules will operate, with one alternately held in reserve to provide redundancy and minimize downtime. Daily throughput and design capacity are 250 and 330 tons, respectively, on a 7-day-per-week basis.

Solid waste with an assumed heating value of 4500 Btu per pound is combusted to produce low-pressure saturated steam at 200 psig. Condenser pressure is at 6" Hg, and feedwater temperature is 200° F.

to the boiler from the deaerating-heater. Blowdown and deaerating vent steam have been assumed to be 1 percent of appropriate flows.

The system has an operating efficiency of 65 percent and an availability factor of 76 percent. The steam is directed through a low-pressure condensing turbine, producing approximately 2832 kwh. Of this electricity, approximately 250 kwh is utilized for internal system requirements, yielding 2682 kwh for export.

Economics

Capital costs are estimated at $6,800,000 in 1979 and are developed from recently submitted proposals by various modular combustion system manufacturers for comparable systems and quotations from several turbo-generating equipment manufacturers. Capitalized expenses, including startup and acceptance costs; contingency; bond financing costs; legal and engineering services; and debt reserve and capitalized interest during construction raise the size of the bond issue to $8,322,000.

Debt service expenses are predicated upon Florida State Pollution Control Bonds at 6 percent for 20 years.

Electricity revenues are predicated upon electricity sold at retail for 28.5 mils ($.0285) less a credit of $10 per kwh capacity, which Florida Power and Light would charge to provide necessary standby capacity.

Net 1979 disposal charges are estimated at $8.00 per ton. The cost of residual disposal based upon a 95-percent volume reduction and 65-percent weight reduction is included in operating expense projections. (See Table 8.)

A 250 TPD_7 Modular Combustion System with Electricity Generation - 1983 Capital and Financing Costs

A 250 TPD_7 modular combustion system with electricity generation - 1983 capital and financing costs is the exact system as above, and thus has the same technical and performance assumptions. The 1983 economics of this system, however, are adversely affected by escalated capital, financing and operational costs, and benefited by increased electricity revenues.

It is assumed that Daytona Beach will generate sufficient waste by 1983 to provide daily tonnage necessary to support a 250 TPD resource recovery system.

The location of the resource recovery facility contiguous to the AWTP and waste water plant would not result in any increase in haul costs for the city, as this site is approximately the same distance from Daytona Beach as is the Tomoka Farms landfill.

Economics

System capital costs are projected at $9,956,000 in 1983. Capitalized expenses of $2,279,000 for startup and acceptance costs; contingency; bond financing costs; legal and engineering services; and debt reserve and capitalized interest during construction bring the total capital costs to $12,235,000.

Interest rates on Florida State Pollution Control Bonds are projected at 6.75 percent, an increase of 75 basis points from 1979 levels.

Electricity revenues are projected at 49.85 mils ($.04985), reflecting a compounded annual increase in electricity costs of 15 percent. Credits of 17.50 per kwh capacity also presume a 15-percent annual escalation since 1979 in the Cost of Florida Power and Light providing standby capacity. Recent OPEC oil pricing increases and the proposed deregulation of domestic oil and gas suggest that 1983 fuel and electricity prices will be dramatically higher.

New 1983 disposal charges are estimated to be $9.00 per ton.

A 250 TPD_7 Modular Codisposal Combustion System with Electricity Generation - 1983 Capital and Financing Costs and Partial Federal Grant

A 250 TPD_7 modular codisposal combustion system has all of the solid waste handling and combustion equipment of the previously described modular combustion system. In addition, however, the codisposal system has necessary sludge handling, drying and conveying equipment. Dewatered sludge at 30 percent solids is conveyed to a sludge drying module, where hot gas from solid waste combustion is

introduced. The sludge is dried to an 85-to-90-percent solids content. At this point the sludge is removed from the sludge drying module and introduced to the primary combustion chamber with solid waste at an approximate ratio of 1 ton of sludge to 25 tons of solid waste.

Daily solid waste throughput and design capacity are 250 and 330 tons, respectively, on a 7-day-per-week basis. Daily sludge throughput is 30 tons, and design capacity is 50 tons on a 7-day-per-week basis.

Solid waste at 4500 Btu's per pound and sludge (30-percent solids) at 4000 Btu's per pound are combusted to produce low-pressure saturated steam at 200 psig. System operating efficiency is 60 percent. The steam is directed through a low-pressure condensing turbine to produce 2616 kwh of electricity. Estimated system electricity requirements of 150 kwh yield 2466 kwh for export.

Eligibility for Federal Grant

Title II of Public Law 92-500, as amended (commonly referred to as the Clean Water Act of 1977), authorizes the Federal government to award grants to communities, regions or states for the purpose of constructing water pollution control facilities. The Clean Water Act of 1977 stressed innovative solutions to improved water quality, specifically citing codisposal technologies as a viable option.

While a codisposal facility qualifies as an innovative solution to water quality problems, a further criterion must be met. To be eligible for a Federal grant, a dual-purpose technology, such as a codisposal facility, must demonstrate that it is more cost-effective than the sum of two or more single-purpose facilities it would replace. The costs of a codisposal facility would be evaluated against the sum of costs for separate and independent solid waste and sludge disposal systems. A 20-year present value analysis is used to determine cost effectiveness. Under this analysis, the capital costs and present value of operation and maintenance expenses of each most cost-effective, single-purpose option are combined and compared to the capital costs and present value of operations and maintenance expenses of the multi-

purpose system. If the multi-purpose system is more cost-effective than the sum of capitalized costs for each single-purpose system, it qualifies for Federal grant consideration.

The allocation formula has not yet been finalized by the Environmental Protection Agency, the administrating authority. However, the current opinion is that at a minimum the grant award would be 85 percent of 115 percent of the capital cost of the least expensive, single-purpose system.

For the sake of analysis in determining the economics of this codisposal option and the 400 TPD_7 mass burn codisposal system, it has been assumed that the minimum grant equivalent to 85 percent of 115 percent of the capital cost of the least expensive single-purpose facility will be available. Estimates of the capital cost of the least expensive single-purpose facility are derived from projections for Alternative No. 3, Filter Press Dewatering and Flash Drying Sludge Disposal System, developed by Russell and Axon in a report entitled Sludge Disposal Alternatives Study, City of Daytona Beach, Florida. The total capital cost of this disposal option is estimated at $5,813,000 in 1983.

Economics

Projected in 1983 capital costs reflecting equipment and construction; startup and acceptance and contingency; engineering and legal services; construction financing/interest expense; and debt reserve and capitalized interest total $17,321,000. An estimated Federal subsidy of $5,683,000 is available to reduce the capital requirements to $11,638,000.

Debt service is predicated upon Florida State Pollution Control Bonds at 6.75 percent for 20 years.

Electricity revenues are based upon retail price of $49.85 mils ($.04985) less standby credits of $17.50 per kwh capacity.

Net solid waste disposal and sludge disposal costs are estimated at $11.00 per ton.

In the economic analysis for both the 250 TPD_7 and 400 TPD_7 codisposal options, capital costs, operational expenses and electricity revenues have been allocated on a proportionate input tonnage basis between MSW and sludge. Because sludge at 30-percent solids has a greater moisture content than MSW, its cost (operational) to process is greater on a per-ton basis. Further, its lower assumed Btu value relative to MSW (4000 Btu's per pound compared to 4500) results in the recovery of less energy; therefore, less revenues per input ton.

While a pro rata allocation simplifies the allocation of costs and revenues between sludge and solid waste for the respective codisposal systems, it also has the effect of increasing per-ton solid waste disposal costs and dramatically reducing per-ton sludge disposal costs. As an example, establishing sludge disposal fees at $60 per ton would result in a reduction of about $6.00 per ton of MSW to a projected 1983 cost of $5.00 for the 250 TPD_7 codisposal system. As many Northeastern and Mid-Atlantic communities currently pay approximately $100 per ton or more to dispose of sludge, a $60-per-ton sludge disposal fee could be justified as reasonable.

A 400 TPD_7 Mass Burn Codisposal System with Electricity Generation - 1983 Capital and Financing Costs and Partial Federal Grant

A 400 TPD_7 mass burn codisposal system with electricity generation consists of solid waste handling and conveying equipment, two 250 TPD_7 waterwall boilers with electrostatic precipitators, one condensing turbine generator set, sludge handling and conveying equipment, and a sludge drying module. As in the above codisposal system, sludge at 30 percent solids enters the sludge drying module, where hot gas from the waterwall boilers is introduced. Sludge, after drying to approximately 85 to 90 percent solids, is removed from the drying module and blended with solid waste for mass burning.

Daily throughput is 400 tons, and daily design capacity is 500 tons--both on a 7-day-per-week basis. All of the solid waste currently disposed at the County facilities would be required to meet system throughput. Sludge disposal capacity is 50 tons per day, with 30 tons per day the initial throughput.

This system has an operating efficiency of 70 percent and an availability factor of 80 percent. (Current availability factors for waterwall incinerators range from 75 to 80 percent. Because of continuing improvements in this technology, the favorable availability assumption of 80 percent was utilized in developing the economics for this system.)

Approximately 78,000 pounds of medium-pressure steam at 600 psig and 700° F are produced per hour. This steam production is based upon a solid waste heating value of 4500 Btu's per pound and a sludge Btu content of 4000 per pound.

Net electricity available for export is 7677 kwh per hour, a figure which considerably exceeds the projected combined energy requirements of the waste water and water treatment plants.

Economics

Estimated equipment capital costs of $42,010,000 for this option were derived from recently submitted bids for comparable systems and escalated by a 10-percent annual factor. The reference system from which this was developed was a 1200 TPD_7 (design capacity) system. It was assumed that this 500 TPD_7 system at 42/100 the scale would cost approximately 50/100 of the reference system. Sludge subcomponent costs were developed separately and added to the system costs. Because this system is a dual-purpose facility, a minimum Federal grant of $5,683,000 is assumed in developing capital and debt service costs.

The total size of the bond issue reflecting startup and acceptance costs; bond financing; legal and engineering services; and debt reserve and capitalized interest during construction approximates $48,642,000.

Debt service of $4,503,000 per year equivalent to $26.00 per inton of solid waste is based upon 6.75 percent financing for 20 terms. It was assumed that Florida State Pollution Bonds would be available to finance this system.

Electricity revenues of $3,304,000 equivalent to $21.00 per input ton of sludge and solid waste is based upon the sale of 7677 kwh on a

24-hour-a-day, 365-day-a-year basis at a retail price of 49.85 mils ($.04985) at 80 percent availability. Because the quantity of electricity generated by this system greatly exceeds the energy requirements of the presumed customer, the City of Daytona Beach for its waste water and water treatment plants, additional customers would be necessary to ensure that all of the electricity produced could be sold. The constraints imposed by Chapter 366 of the Florida Statutes could prevent the sale of electricity to other retail customers, necessitating the sale of surplus electricity from this system to Florida Power & Light at a price considerably below projected retail, thereby reducing electricity revenues and increasing net disposal charges.

Under the more favorable assumption that all electricity produced can be sold at retail, solid waste and sludge disposal costs are projected at $24.00 per ton.

Summary of Resource Recovery Options

The production of electricity by a 250 TPD_7 modular combustion resource recovery system appears economically viable and seems reasonably competitive with Daytona Beach's projected 1983 landfill disposal costs. This conclusion is based upon estimated 1983 net dipsosal costs for a 250 TPD_7 modular combustion system both with and without sludge disposal capability, with the following assumptions implied:

- Resource recovery system capital costs will escalate 10 percent per year (linear basis).
- Landfill disposal costs, exclusive of the impact of more stringent practices mandated by RCRA, will increase by 7 percent per year (linear basis).
- Electricity produced from a resource recovery system of this scale can be sold at retail.
- The price of electricity will increase by 15 percent per year (compound basis).

If these assumptions hold, a 250 TPD_7 modular combustion system will result in 1983 disposal costs of $9.00 per ton compared to projected landfill costs (exclusive of RCRA), ranging from $5.24 to $6.99 for the City of Daytona Beach.

A 250 TPD_7 modular combustion codisposal system with partial Federal grant will result in 1983 disposal costs of $11.00 per ton if operational costs and revenues are allocated between solid waste and sludge on a pro rata input ton basis. A fee structure reflecting differences in processing costs and energy value between sludge and solid waste would result in signficantly more competitive solid waste disposal costs. As an example, a $60-per-ton sludge disposal fee, considered very competitive in some communities, would enable the resource recovery system to reduce net solid waste disposal fees to $5.00 per ton.

The 400 TPD_7 mass burn codisposal system with benefit of partial Federal grant projects 1983 net disposal costs of $24.00 per ton of solid waste and thus is not competitive with landfill disposal.

TABLE 7

COMPARATIVE ECONOMICS

Year	System	Financed	Net Disposal Costs
1979	250 TPD_7 Modular Combustion System/ Electricity production	No Federal grant	$ 8.00
1983	250 TPD_7 Modular Combustion System/ Electricity production	No Federal grant	9.00
1983	250 TPD_7 Modular Combustion Codisposal System/Electricity production	Partial Federal grant	11.00
1983	400 TPD_7 Mass Burn Codisposal Incinerator Electricity production	Partial Federal grant	24.00

TABLE 8

1979

SYSTEM ECONOMICS FOR 330 TPD_7 MODULAR
COMBUSTION UNIT WITH ELECTRICITY GENERATION
(Nominal Rating 250 TPD_7)

THROUGHPUT:		91,250 TPY
NET ELECTRICITY AVAILABLE FOR EXPORT:		2682 KWH
TOTAL CAPITAL COSTS:		$ 8,332,000
Equipment & Construction	$6,800,000	
Startup & Acceptance and Contingency at 10% of capital costs	680,000	
Engineering Consulting	75,000	
Bond Financing	25,000	
Legal	25,000	
Debt Reserve Capitalized Interest	727,000	
OPERATING COSTS:		$ 15.00
Debt Service	$ 726,000	
Debt Service/Ton		8.00
O, M & R	639,000	
O, M & R/Ton		7.00
LESS: ELECTRICITY REVENUES		
Total Revenues	< 643,000>	
Revenues/Ton		< 7.00>
NET DISPOSAL COSTS		
Net Disposal Cost	722,000	
Net Disposal/Ton		8.00

TABLE 8--Continued

ASSUMPTIONS:

- 76% system operating factor, six 55 TPD modules--five to be operated, one for backup
- System operates 365 days per year, 24 hours per day
- 65% system efficiency
- 4500 Btu/lb MSW
- 200 psig saturated steam, 6" Hg condenser pressure, 200° F feedwater to boiler from deaerating-heater
- 19.81 lbs steam/kwh
- 2832 kwh produced by system; 2682 kwh available for export
- Debt service predicated upon 6% financing, 20-year term
- Electricity revenues based upon:
  - .0285 retail price of electricity
  - less $10 per kwh capacity charge

Note: IRS Rules on tax exemption permit only 10% of net bond proceeds to be used to cover costs not directly tied to solid waste processing facilities. In this case the solid waste processing facility would include steam generation but not steam line or turbo generator. Because the steam line and turbo generator are estimated to cost $500,000, they can be financed with tax-exempt bonds.

TABLE 9

1983

SYSTEM ECONOMICS FOR 330 TPD_7 MODULAR COMBUSTION UNIT

WITH ELECTRICITY GENERATION

(Nominal Rating 250 TPD_7)

THROUGHPUT:		91,250 TPY
NET ELECTRICITY FOR EXPORT:		2682 KWH
TOTAL CAPITAL COSTS:		$12,235,000
Equipment & Construction	$ 9,956,000	
Startup & Acceptance and Contingency at 20% of capital costs	996,000	
Engineering Consulting	100,000	
Bond Financing	25,000	
Legal	25,000	
Debt Reserve Capitalized Interest	1,133,000	
OPERATING COSTS:		$ 21.00
Debt Service	$ 1,133,000	
Debt Service / Ton		12.00
O, M & R	837,000	
O, M & R / Ton		9.00
LESS: ELECTRICITY REVENUES		
Total Revenues	< 1,124,000 >	
Revenues / Ton		< 12.00 >
NET DISPOSAL COSTS		
Net Disposal Cost	846,000	
Net Disposal / Ton		9.00

TABLE 9--Continued

1983 ASSUMPTIONS:

Capital costs escalated 10% per year; O&M&R costs escalated 7% per year; electricity revenues escalated 15% per year.

- 76% system operating factor, six 50 TPD modules--five to be operated, one for backup
- System operates 365 days per year, 24 hours per day
- 65% system efficiency
- 4500 Btu/lb MSW
- 200 psig saturated steam, 6" Hg condenser pressure, 200° F feedwater to boiler from deaerating-heater
- 19.81 lbs steam/kwh
- 2832 kwh produced by system; 2682 kwh available for export
- Debt service predicated upon 6.75% financing, 20-year terms
- Electricity revenues based upon:
  - .04985 retail price of electricity
  - less $17.50 per kwh capacity charge

TABLE 10

1983

ECONOMICS FOR 330 TPD_7 CODISPOSAL MODULAR
COMBUSTION SYSTEM WITH ELECTRICITY GENERATION
(Nominal Rating 250 TPD_7)

THROUGHPUT:		102,200 TPY
MSW	91,250	
Sludge	10,950	
NET ELECTRICITY AVAILABLE FOR EXPORT:		2466 KWH
EQUIPMENT CAPITAL COSTS:		$13,596,000
Solid Waste System	9,956,000	
Codisposal Equipment	963,000	
Dewatering System	2,677,000	
TOTAL CAPITAL COSTS:		11,638,000
Equipment & Construction	13,596,000	
Startup & Acceptance and Contingency at 10% of capital costs	1,360,000	
Engineering Design & Project Mgt. at 8% of capital costs	1,088,000	
*Construction Financing/ Interest Expense	100,000	
Bond Financing	50,000	
Legal	50,000	
Debt Reserve Capitalized Interest	1,077,000	
LESS: Estimated Federal Subsidy	< 5,683,000 >	

TABLE 10--Continued

OPERATING COSTS:		$21.00
Debt Service	$1,077,000	
Debt Service / Ton		$10.00
O,M & R	1,100,000	
O,M & R / Ton		$11.00
LESS: ELECTRICITY REVENUES		
Total Revenues	<1,034,000>	
Revenues / Ton		<$10.00>
NET DISPOSAL COSTS:		
Net Disposal Cost	1,143,000	
Net Disposal / Ton		$11.00

TABLE 10--Continued

ASSUMPTIONS:

- Solid waste components procured under full service contract
- Sludge processing components procured under conventional design/construction arrangements
- Construction financing/interest expense limited to sludge processing components and based upon 10% interest and 18-month construction period
- Capital costs, operational expenses and energy revenues are allocated to MSW and sludge on a proportionate input basis
- 76% system operating factor, six 55 TPD modules--five to be operated, one for backup
- System operates 365 days per year, 24 hours per day
- 60% system efficiency
- 4,500 Btu/lb MSW
- 4,000 Btu/lb sludge
- 200 psig saturated steam, 6" Hg condenser pressure, 200° F feedwater to boiler from deaerating-heater
- 19.81 lbs steam/kwh
- 2616 kwh produced by system; 2466 available for export
- Debt Service predicated upon 6.75% financing, 20-year terms via Florida State Pollution Control Bonds
- Electricity revenues based upon:
  - .04985 retail price of electricity
  - less $17.50 per kwh capacity charge

TABLE 11

1983

ECONOMICS FOR 500 TPD_7 MASS BURN WATERWALL INCINERATOR
CODISPOSAL SYSTEM
(Nominal Rating 400 TPD_7)

THROUGHPUT:		156,950 TPY
MSW	146,000 TPY	
Sludge	10,950 TPY	
NET ELECTRICITY AVAILABLE FOR EXPORT:		7677 KWH
EQUIPMENT CAPITAL COSTS:		$42,010,000
Solid Waste System	38,370,000	
Codisposal Equipment	963,000	
Dewatering System	2,677,000	
TOTAL CAPITAL COSTS:		48,642,000
Equipment Capital Costs	$42,010,000	
Startup & Acceptance and Contingency at 10% of capital costs	4,201,000	
Engineering Design & Project Mgt. at 8% of capital costs	3,361,000	
Construction Financing/ Interest Expense	100,000	
Bond Financing	100,000	
Legal	50,000	
Debt Reserve Capitalized Interest	4,503,000	
LESS: Estimated Federal Subsidy	< 5,683,600 >	

TABLE 11--Continued

OPERATING COSTS:		
Debt Service	$4,503,000	
Debt Service / Ton		$29.00
O,M & R	$2,563,000	
O,M & R / Ton		$16.00
LESS: ELECTRICITY REVENUES		
Total Revenues	< $3,218,000 >	
Revenues / Ton		< $21.00 >
NET DISPOSAL COSTS		
Net Disposal Cost	$3,847,000	
Net Disposal Cost / Ton		$24.00

TABLE 11--Continued

ASSUMPTIONS:

- Solid waste components procured under full service contract
- Sludge processing components procured under conventional design/construction arrangements
- Construction financing/interest expense limited to sludge processing components and based upon 10 percent and 18 month construction period
- Capital costs, operational expenses and energy revenues are allocated to MSW and sludge on a proportionate input basis
- 80 percent system operating factor
- System operates 365 days per year, 24 hours per day
- 70 percent system efficiency
- 4,500 Btu/lb MSW
- 4,000 Btu/lb sludge
- Steam produced at 600 psig, 700F
- 10 lb steam/kwh
- 466.67 kwh/Ton MSW
- 39.51 kwh/Ton sludge
- 7827 kwh produced by system, 7677 kwh available for export.
- Debt service predicated upon 6.75 percent financing, 20 year terms via Florida State Pollution Control Bonds
- Electricity revenues predicated upon:
  - .04485 retail price of electricity
  - less $17.50 per KWH capacity charge

TABLE 12

MANUFACTURERS* OF MODULAR COMBUSTION SYSTEMS

- Basic Environmental Engineering Corp.
  Glen Ellyn, IL
- Comtro Division, Sunbeam Equipment
  Lansdale, PA
- Consumat Systems, Inc.
  Richmond, VA
- Environmental Control Products, Inc. (ECP)
  Charlotte, NC
- Kelley Company, Inc.
  Milwaukee, WI
- Progressive Equipment Co., Inc.
  Bloomfield, CT
- Trofe Incineration, Inc.
  Mt. Laurel, NJ
- Washburn & Granger, Inc.
  Paterson, NJ

*This list does not constitute an endorsement of the equipment produced by any of the above firms, and is believed to be correct as of May 1, 1979. There may be other manufacturers of this equipment, of which the consultant is not aware.

TABLE 13

MANUFACTURERS* OF SOLID WASTE WATERWALL INCINERATOR SYSTEMS

- Babcock & Wilcox Company
  Baberton, OH

- Combustion Engineering, Inc.
  Windsor, CT

- Foster-Wheeler Energy Corporation
  Livingston, NJ

- Grumman Ecosystems Corporation
  Melville, NY

- UOP, Inc.
  Des Plaines, IL

- Wheelabrator-Frye, Inc.- Subsidiary of Europe
  Hampton, NH

- Widmer-Ernst, Inc.
  New York, NY

*This list does not consitute an endorsement of the equipment produced by any of the above firms. The list is believed to be correct as of May 1, 1979. There may be other manufacturers of this equipment of which the consultant is not aware.

CHAPTER V

OTHER PROJECT CONSIDERATIONS

There are a number of project considerations other than technical reliability and economic viability which must be considered. Chief among these are included regulatory considerations, availability and characteristics of processible waste, the impact of resource recovery on current landfill practices and costs, siting issues, and system eligibility for a Federal grant.

Regulatory Considerations

A resource recovery facility generating electricity would be governed by State statutes concerning siting and retail sale pricing. The Power Plant Siting Act 403, Part 2, Florida Statutes, Chapters 17-1 and 17-3, covers the implementing rules which balance need versus environmental impact. Whether a small-scale generator in the range of 2.6 MW, such as the modular combustion codisposal system considered in this study, would come under this Act must be determined. If the County were to be the project sponsor/owner of a system producing electricity for sale to the Regional Advanced Water Treatment Facility, this consideration would be critical.

In the case of Daytona Beach project ownership, the production of electricity for the Advanced Waste Water Treatment Facility would be viewed as non-utility electricity generation for internal use and thus may not be affected by the restrictions imposed by these rules.

Legal research and an advisory opinion from the Florida State Attorney General and Public Service Commission may be necessary to clarify these issues. As a potential retail seller of electricity, a resource recovery facility could be governed under Chapter 366 of the Florida Statutes. Under this Statute, a need for additional electricity generation within a franchised area must be proven. However, the Federal Public Utility Regulation Act of 1978, Title II, which encourages cogeneration and small-scale power production by primary users, may ease the requirements of Chapter 366 of the Florida Statutes.

Availability and Characteristics of Processible Waste

Waste availability and characteristics are paramount project considerations. Estimates of waste currently disposed of in Volusia County, including County- and non-County-operated facilities, range from approximately 600 to 800 tons per day. However, a weighing and compositional analysis must be performed to reconcile these conflicting estimates to quantify exactly the tonnage of solid waste generated by the City of Daytona Beach and the remainder of Volusia County and to determine the percentage of available waste appropriate for resource recovery processing. The compositional analysis may indicate that the unprocessible portion differs from the 20% figure assumed for this study and will also determine the heating value of the processible portion of the waste stream. From this weighing and composition analysis, firm steam output and electrical generation estimates as well as design parameters for the combustion units can be developed.

Impact of Resource Recovery on Current Practices

A city of Daytona Beach resource recovery project would divert about 40% of the waste that otherwise would be delivered to the County-operated Tomoka Farm landfill. The effect of this would be to extend the remaining life of that landfill. A possible negative impact might be a possible increase in per-ton disposal costs as solid waste quantities are reduced and fixed costs remain constant.

To the extent that other disposal facilities will be closed within this time-frame--such as the Ormond Beach landfill, which has an estimated annual tonnage of 22,000 tons per year, and the Lake Helen City landfill, with an annual tonnage of 350 tons per year--it is likely that a portion of this loss would be compensated for by waste delivered from other generators.

If a resource recovery project with codisposal capability is undertaken, disposal practices and resultant landfill costs may be adversely impacted. Under proposed regulations promulgated by EPA and published in December 1978, codisposal facilities may be classified as hazardous waste combusting facilities and the residue produced will require handling and disposal according to hazardous waste disposal guidelines. This could increase operating costs of the recovery project.

Treatment of the residue from codisposal as a hazardous waste will require additional capital and operational expenditures to assure compliances with the full mandates of RCRA.

Siting Issues

According to officials in the Volusia County Planning Department, there appear to be no zoning restrictions or other impediments to the siting of a resource recovery facility assuming County ownership.

It is also the belief that a resource recovery facility owned by the City of Daytona Beach would not encounter siting or zoning impediments.

System Eligibility

The assumption that a codisposal resource recovery system is eligible for Federal grant under Title II of Public Law 92-500 must be verified. Because the availability of Federal Grant for a codisposal facility has a significant impact on ultimate capital and debt service costs, assessing eligibility for this support may be necessary in order to determine the project's economic feasibility.

CHAPTER VI

NEXT STEPS

The City of Daytona Beach has been selected to negotiate with the Environmental Protection Agency for a grant under the President's Urban Grants Program to determine the feasibility of a codisposal facility.

Further steps which must be undertaken before implementing this codisposal facility or any other resource recovery project within Volusia County include:

- Determine the quantity and characterization of the solid waste stream, including gross tonnages, processible tonnages, and heat value of solid waste
- Determine the quantity and characteristics of the sludge available for codisposal including moisture content, and heating value
- Implement necessary interlocal agreements so that sufficient volumes of sludge are available to support the requirements of an optimum configuration system
- Perform detailed evaluations of candidate resource recovery system technologies, especially technical compatibility of low-pressure steam generation with fluctuation in steam generated from combustion of MSW and sludge to determine the optimum configuration system
- Develop technical and economic tradeoffs of the production of moderate-pressure (600-800^{o}F) steam to generate electricity and evaluate against the low-pressure steam reference system envisioned within this report
- Determine appropriate financial mechanisms, including grant eligibility, grant amount and allocation of grant between solid waste and sludge drying handling components of the system, and develop an equitable fee structure for solid waste and sludge
- Mitigate institutional, legal and other impediments, especially Power Plant Siting Act 403 and Chapter 366 impacts

- Determine the appropriate sponsorship/ownership arrangement.

Before undertaking a resource recovery project, analysis of the County's solid waste stream must be performed to determine the characteristics, quantities, origin and disposal destination to assure that sufficient processible waste can be obtained to support the candidate resource recovery system. As well, the quantities and characteristics of sludge, including moisture content and heating value, must be determined.

It may be necessary to implement interlocal agreements between the various sludge generating communities to ensure a consistent supply of sludge so that the requirements of an optimum configuration codisposal system can be met.

Detailed technical evaluation of candidate resource recovery systems must be performed. Energy and mass balances must be calculated to ensure system compatibility with available waste inputs. For codisposal technologies the net energy impact of sludge codisposal upon the resource recovery system must be determined. Resource recovery system efficiencies must be evaluated and the operating parameters of low-pressure steam production with electrical generation must be determined.

The development of first-order economics for the reference 330 TPD_7 (250 TPD_7 nominal) codisposal modular combustion system assumed the production of low-pressure saturated (200 psig) steam. However, the concept of producing medium-pressure (600-800 psig) steam to generate electricity from the co-combustion of solid waste and sludge in a modular small-scale system also appears technically feasible. While the capital cost of the medium-pressure system is increased due to an upgrading of turbine and electric generating equipment, system efficiency vis-a-vis electricity production is increased with a potential for a corresponding increase in electricity revenues. Thus, it is necessary to develop the technical and economic tradeoffs of a medium-pressure steam system and evaluate against the reference low-pressure steam system to ensure that the optimum system is implemented.

While it appears that a codisposal system is eligible for Federal

201 grant under PL 92-500, the magnitude of this support is unknown. It is necessary to determine the allocation of this grant between solid waste and sludge processing subsystems and to develop an equitable fee structure for solid waste and sludge. As pointed out previously a pro rata allocation of costs and revenues appears to subsidize the disposal of sludge and to increase the per ton cost of solid waste disposal.

Alternative ownership and financing strategies must be evaluated to determine the most cost-effective financing mechanism. In the case of private ownership no construction grants are available. Therefore, it is necessary that the economics of both private and public ownership be analyzed to determine whether the tax benefits of private sector ownership result in more faborable net disposal costs.

With public sector ownership, it must be determined whether financing under the State Pollution Control Bond Act will still be available or whether the heavy demand made by the Dade County Resource Recovery project and the likely financing of the Pinellas County project will have exhausted this funding vehicle.

Other legal and institutional issues, including facility siting and ownership, must be addressed to ensure timely and cost-effective implementation.